

**Delaware Nutrient Management
Program**
**DELAWARE CONSERVATION
PRACTICE STANDARD**
**DELAWARE PHOSPHORUS SITE
INDEX**

DEFINITION

An assessment tool designed to evaluate site characteristics and management factors in determining phosphorus loss to the environment.

PURPOSES

1. To assess the relative risk of phosphorus (P) loss from differing fields allowing the design of best management practices to reduce agricultural P losses to surface waters. The P site index (PSI) is not designed to estimate the actual quantity of P lost in runoff from a field.
2. Prioritize the locations in a watershed where BMPs will have the greatest water quality benefits.
3. Provides a systematic assessment that evaluates site characteristics to obtain an overall rating of the potential for P loss from soils at a site. The site characteristics are separated into two groups:
 - Site factors affecting P transport
 - P source and management factors
2. The use of the PSI and properly managing P at a site may not only improve waters of the State surrounding a given site but also may allow a farmer more flexibility in P application based on the site specific characteristics of a farm. In addition, by utilizing the PSI a farmer may not be limited to a three year crop removal rate of P in fields.
3. Soil test information used to determine the PSI may not be older than three years.
4. Proper P management is a critical for Delaware as part of an overall strategy to reduce P loading and improve water quality to achieve goals of the Clean Water Act. This is especially true for water quality limited waterbodies (waterbodies that need pollution reduction beyond that achievable with existing control measures). Currently, many waterbodies in Delaware are water quality limited waterbodies.

**CONDITIONS WHERE PRACTICE
APPLIES**

The practice applies at farms in the State of Delaware (Delaware) that have high P in soils. While sites with high P soil levels may apply a three year crop removal rate of P to a field, an alternative to this practice is to calculate the PSI for sites with high P soil levels and then implement the P management strategy

recommended in the PSI. In Delaware, high P soil are defined by the Nutrient Management Commission as soils with a test value greater than 150 FIV, 150 ppm Mehlich 3, 120 ppm Bray P1, or 75 ppm Mehlich 1 (For more information, see “Interpreting Soil Phosphorus Tests” at: <http://ag.udel.edu/extension/agnr/pdf/nm-04.pdf>)

CONSIDERATIONS

1. It is important to not strictly assess the risk of P loss from soil to water by solely focusing on a soil test P value. Rather, a much broader, multi-disciplinary approach is needed, one that recognizes that P loss will vary among watersheds and soils, due to the rate and type of soil amendments used, and due to the wide diversity in soils, crop management practices, topography, and hydrology (Sims, 1998a; Sims et al., 1998). The PSI is a BMP that addresses these points.

CRITERIA

Criteria Applicable to All Purposes

In June of 1999 Delaware passed the Delaware Nutrient Management Act, which requires most

farms in Delaware to develop a nutrient management plan. Nutrient management plans are a crucial to ensure that farmers are able to apply nutrients to their fields at rates that result in optimum crop yields (most profitable), while also ensuring that impacts to waters of the State from excessive nutrient application is minimized. An important step in developing a nutrient management plan is determining if there are any fields on a farm that have soils with high P levels. P is an essential nutrient for plant growth and excessive levels of P in Delaware's water supplies can lead to biological and ecological problems. High P soils are defined by the Nutrient Management Commission as soils with test value greater than 150 FIV (Fertility Index Value), 150 ppm Mehlich 3, 120 ppm Bray P1, or 75 ppm Mehlich 1. Upon determining which fields on a farm have high P levels in soil, a site may implement one of two BMP options.

Option one: facilities with high P soils may apply a three year crop removal rate of P to each field that has high P.

Option two: facilities with high P soils may determine the PSI for the field and then implement the P management strategy recommended by Delaware's PSI. The Delaware PSI, entitled "The Phosphorus Site Index: A Phosphorus Management Strategy for Delaware's Agricultural Soils" is located at: <http://ag.udel.edu/extension/agnr/pdf/st-05.pdf>

Losses of P by runoff and erosion are not only dependant on the amount of P in or added to a soil but also dependant on the transport process that control soil and water movement from fields to waters of the State.

The PSI evaluates site characteristics, which are separated into two groups:

- Site and Transport Characteristics (i.e., soil erosion and runoff)
- Source and Management Characteristics

Site and Transport Characteristics include:

1. Soil erosion
2. Soil surface runoff class
3. Subsurface drainage

4. Leaching potential
5. Distance from field to surface water
6. Priority of receiving water

Source and Management Characteristics:

1. Soil test P value
2. P fertilizer application rate
3. P fertilizer application method
4. Organic P source application rate
5. Organic P source application method

Each of the site characteristics in the PSI is assigned a numerical value from an interpretive rating scale (VERY LOW, LOW, MEDIUM, HIGH or VERY HIGH) or from calculations using a weighting factor based on the relationship between the characteristic and the potential for P loss from the site. The final PSI value for the site integrates the effects of factors from Site and Transport Characteristics and Source and Management Characteristics to calculate the overall rating of the potential for P loss at the site (the PSI value).

PSI values are designated as follows and generally shall be interpreted as the following:

- < 50 – LOW potential for P movement from site given current management practices and site characteristics. There is a low probability of an adverse impact to surface waters from P losses from this site. Nitrogen-based nutrient management planning is satisfactory for this site.
- 51-75 – MEDIUM potential for P movement from this site given current management practices and site characteristics. Practices should be implemented to reduce P losses by surface runoff, subsurface flow, and erosion. Nitrogen-based nutrient management should be implemented no more than one year out of the three. Phosphorus-based nutrient management should be implemented two years out of three during which time P applications should be limited to the amount expected to be removed from the field by

crop harvest or soil test P based application recommendations, whichever is greater.

- 76-100 – HIGH potential for P movement from this site given current management practices and site characteristics. Phosphorus-based nutrient management should be used for this site. Phosphorus applications should be limited to the amount expected to be removed from the field by crop harvest or soil test P based application recommendations. All practical management practices for reducing P losses by surface runoff, subsurface flow, or erosion should be implemented.
- > 100 – VERY HIGH potential for P movement from this site given current management practices and site characteristics. No phosphorus should be applied to this site. Active remediation techniques should be implemented in an effort to reduce the P loss potential of this site.
- In accordance with the Delaware Nutrient Management Law/regulations, fields with high P soil levels cannot have more than a three-year crop removal rate of P applied during a three year period or must have the PSI calculated at least once every three years and follow the P management strategy recommended by Delaware's PSI.

PLANS AND SPECIFICATIONS

Plans and specifications for this practice shall be prepared in accordance with the previously listed criteria. Plans and specifications shall contain sufficient detail to ensure successful implementation of this practice.

Documentation shall be in accordance with the section "Supporting Data and Documentation" in this standard.

SUPPORTING DATA AND DOCUMENTATION

The following is a list of the minimum data and documentation to be recorded in the case file:

1. The PSI must be calculated using the spreadsheets in the "Delaware Phosphorus Site Index Excel Spreadsheet for Calculation of P Site Index Values" updated July 2010. Additional information on the PSI may be found in the University of Delaware's document "The Phosphorus Site Index, "A Phosphorus Management Strategy for Delaware Agriculture, Training Manual dated May 1, 2002.

REFERENCES

1. Dr. J. Sims and Dr. A. Leytem. 2002. "The Phosphorus Site Index: A Phosphorus Management Strategy for Delaware's Agricultural Soils", Department of Plant & Soil Science, University of Delaware, Soil Testing Program, (ST-05).
2. Dr. J. Sims, Dr. A. Leytem and Dr. F. Coale. 2002. "The Phosphorus Site Index: A Systematic Approach to Assess the Risk of Nonpoint Source Pollution of Delaware Waters by Agriculture Phosphorus, Training Manual.
3. Nutrient Management Commission, Dr. G. Binford and Dr. D. Hansen. 2002. "Defining "High" P Soils in Delaware". Delaware Nutrient Management Notes. Vol. III, No. 1.
4. Dr. J. Sims, Dr. A. Leytem and Dr. K. Gartley. 2002. "Interpreting Soil Phosphorus Tests".